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EXAMINER	
LAROSE, COLIN M	
ART UNIT	**PAPER NUMBER**
2623	

DATE MAILED: 08/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/444,034	PATTIKONDA ET AL.	
	Examiner	Art Unit	
	Colin M. LaRose	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *29-40 and 42-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *29-34,36-40 and 42-50* is/are rejected.

7)☒ Claim(s) *35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Arguments and Amendments

1. Applicants' amendments and arguments filed 13 April 2005, have been entered and made of record.

Response to Amendments and Arguments

2. In response to Applicant's amendment to claim 40 and the cancellation of claim 41, the previous rejections under 35 USC 112 for those claims have been withdrawn.

3. In the previous rejection under 35 USC 112, Applicant was requested to provide support in the original Specification for claims 36 and 37. This request is maintained below.

4. Applicant has amended claim 40 to denote that a plurality of lines are "simultaneously" formed from at least one coherent light source. Goshorn, as best understood by the Examiner, utilizes two "wide" laser beams of light, which alternately illuminate the surface of the object being inspected. Goshorn does not disclose "simultaneously" illuminating the surface with a plurality of lines of light, as required by the claim. However, this limitation is considered to be an obvious variant of Goshorn in view of U.S. Patent 4,767,212 by Kitahashi et al., as explained below. A similar limitation is found in new claim 42, and the above remarks are applicable to claim 42.

5. Regarding claim 40, Applicant argues (see p. 8 of the Remarks) that Goshorn does not disclose a camera that captures an image of the lines emitted by the lasers "as [the lines] move with respect to the surface." Applicant asserts that although Goshorn's platform 50 moves with respect to the cameras 23-30, "it does not move while the images are being captured."

Examiner respectfully disagrees. As best understood by the Examiner, Goshorn's system is utilized for inspecting articles such as PCBs. Goshorn employs a platform 50 (figure 8A), which sweeps across the surface of the PCB 14 in a duration of about 2 seconds (e.g. column 5, lines 41-53). The platform comprises the camera 23 and the laser sources 20 and 22, so as the platform traverses the length of the PCB, the camera 23 acquires images of the lines of strobed light produced by the two laser sources 20 and 22.

Thus, in a span of about two seconds, the platform sweeps across the length of a PCB (the length of which is usually about 4 inches, or 8-10 inches for larger motherboards), and the camera captures images of the lines of strobed light produced by the laser sources. The camera therefore is considered to capture images of the strobed lines of light as they move across the PCB. Similar limitations are found in new claims 42 and 47, and the above remarks are applicable to claims 42 and 47.

Claim Objections

6. The following sections of 37 CFR §1.75(a) and (d)(1) are the basis of the following objection:

> (a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.
>
> (d)(1) The claim or claims must conform to the invention as set forth in the remainder of the specification and the terms and phrases used in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description.

7. Claims 45 and 46 are objected to under 37 CFR §1.75(a) and (d)(1) as failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention.

Claims 45 and 46 refer to "the first visible light source," for which there is no antecedent basis. For examination purposes, claims 45 and 46 are both presumed to depend from claim 44. Correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 36 and 37 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The Examiner is not sure whether claims 36 and 37 are supported by the original disclosure and accompanying claims. Examiner respectfully requests that the Applicant provide support for the limitations of these claims by pointing to specific passages in the original Specification.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claim 47 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,495,337 by Goshorn et al. ("Goshorn").

Regarding claim 47, Goshorn discloses a method of inspecting a structure-bearing surface of an object, said method comprising the steps of:

forming at least one line on the surface using a light emitted from a coherent light source at a first wavelength and strobed at a predetermined exposure time (column 5, lines 54-60: line 53 formed by projector 20 at some wavelength of light; column 5, lines 50-53: laser light is strobed);

moving the line with respect to the surface (column 5, lines 43-50 and figure 8A: laser projector 20, mounted to the platform 50, is moved across the surface);

capturing the image of the lines as the line moves with respect to the surface (column 5, lines 50-53: cameras 23-30 record the reflected beam images as the platform moves); and

determining height information for structures on the surface from the image of the line (column 6, lines 9-13: height, H_{SS}, is determined).

Claim Rejections - 35 USC § 103

12. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

13. Claims 29, 40, 42-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,495,337 by Goshorn et al. ("Goshorn") in view of U.S. Patent 4,767,212 by Kitahashi.

Regarding claim 40, Goshorn discloses a method of inspecting a structure-bearing surface of an object, said method comprising the steps of:

forming at least one line on the surface using a light emitted from at least one coherent light source at a first wavelength and strobed at a predetermined exposure time (column 5, lines 54-60: line 53 formed by projector 20 at some wavelength of light; column 5, lines 50-53: laser light is strobed);

moving the line with respect to the surface (column 5, lines 43-50 and figure 8A: laser projector 20, mounted to the platform 50, is moved across the surface);

capturing the image of the lines as the line moves with respect to the surface (column 5, lines 50-53: cameras 23-30 record the reflected beam images as the platform moves); and

determining height information for structures on the surface from the image of the line (column 6, lines 9-13: height, H_{SS}, is determined).

Goshorn discloses that the laser projectors 20 and 22 each produce a single beam of light. Also, Goshorn teaches that laser projectors 20 and 22 are strobed so that they alternately illuminate the surface. Therefore, Goshorn does not discloses at least one coherent light source that "simultaneously" illuminates the surface of the object with a plurality of lines.

Kitahashi discloses a system for projecting light onto an object for the purposes of determining height information regarding the object (see e.g. figures 1-2). Similar to Goshorn, Kitahashi discloses an arrangement where the light from a projector P is projected onto an object Q at some oblique angle, and a camera Z receives images of the reflected light from overhead. Also, Kitahashi discloses a slit S, which is placed in front of the projector. The slit divides the light into a plurality of lines, which are then projected onto the object for the purpose of determining height characteristics thereof. Kitahashi discloses the slit pattern may comprise a plurality of stripes (e.g. figure 11(a)), or it may comprise a grid pattern (e.g. figure 11(b)).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Goshorn by Kitahashi to include a slit pattern S, which causes the light projected from Goshorn's light source 20 to comprise a plurality of lines as claimed, since Kitahashi shows that, in an inspection system where an object is either in motion or at rest, and light is projected onto the object at an oblique angle for the purpose of determining height characteristics of the object, it is both conventional and advantageous to divide the projected light into either a plurality of stripes or a grid pattern in order to facilitate the computation of height information for the object (see e.g. column 3, lines 5-31; column 4, lines 38-43; and column 11, lines 3-13).

Regarding claim 29, Kitahashi discloses that the plurality of lines produced by the slit projector form a grid on the surface of the object (see e.g. figure 4(a)).

Regarding claim 42, Goshorn discloses an optical inspection system (figure 1) for inspecting a structure-bearing surface of an object, said system comprising:

at least one coherent light source (projector 20) that simultaneously illuminates the surface of the object with a single line (i.e. coherent lines of light 53), said at least one coherent source being mounted such that the line created by the at least one coherent light source can be moved over an area of interest on the surface of the object (figure 8A: laser source 20 is mounted to movable platform 50);

a camera movably mounted above the surface such that the camera may be moved to capture an image of the line as it moves with respect to the surface being inspected (figure 8A: camera 23 mounted on the movable platform 50 in order to capture images of the strobed line of laser light from laser source 20 as it sweeps across the surface 14);

wherein the at least one coherent light source is strobed (column 5, lines 50-53: projector 20 is strobed) at a first predetermined exposure time, thereby controlling exposure time of the camera to the illumination created by the at least one coherent light source (column 12, lines 25-36: lasers are strobed at predetermined intervals, which determines the exposure timing from the cameras 23-30); and

a computer (processors 21A-21H, column 5, lines 22-27) that determines height information for the structure from the captured image of the line.

Goshorn discloses that the laser projectors 20 and 22 each produce a single beam of light. Also, Goshorn teaches that laser projectors 20 and 22 are strobed so that they alternately

illuminate the surface. Therefore, Goshorn does not discloses at least one coherent light source that "simultaneously" illuminates the surface of the object.

Kitahashi discloses a system for projecting light onto an object for the purposes of determining height information regarding the object (see e.g. figures 1-2). Similar to Goshorn, Kitahashi discloses an arrangement where the light from a projector P is projected onto an object Q at some oblique angle, and a camera Z receives images of the reflected light from overhead. Also, Kitahashi discloses a slit S, which is placed in front of the projector. The slit divides the light into a plurality of lines, which are then projected onto the object for the purpose of determining height characteristics thereof. Kitahashi discloses the slit pattern may comprise a plurality of stripes (e.g. figure 11(a)), or it may comprise a grid pattern (e.g. figure 11(b)).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Goshorn by Kitahashi to include a slit pattern S, which causes the light projected from Goshorn's light source 20 to comprise a plurality of lines as claimed, since Kitahashi shows that, in an inspection system where an object is either in motion or at rest, and light is projected onto the object at an oblique angle for the purpose of determining height characteristics of the object, it is both conventional and advantageous to divide the projected light into either a plurality of stripes or a grid pattern in order to facilitate the computation of height information for the object (see e.g. column 3, lines 5-31; column 4, lines 38-43; and column 11, lines 3-13).

Regarding claim 43, Kitahashi discloses that the plurality of lines produced by the slit projector form a grid on the surface of the object (see e.g. figure 4(a)).

Regarding claim 44, Goshorn discloses a first visible light source (projector 22) for illuminating the surface of the object (with beam 54), wherein the camera captures a first image of the surface when it is illuminated by the first visible light source (column 7, lines 21-25) and the computer determines two-dimensional structure information from the first image (column 7, lines 36-45 and figure 2b: a base distance B_{SR} is calculated by the processors 21A-21H based on at least one of the eight images of the surface containing the reflected beam 54).

Regarding claim 45, Goshorn discloses that the visible light at a second wavelength is strobed at a second predetermined exposure time, thereby controlling the exposure time of the camera to illumination from the first visible light source (i.e. Goshorn's laser 54 from projector 22 is strobed at an exposure time different from the first laser 53, so that the two lasers alternately illuminate the surface, and the camera 23 is controlled so that it captures images corresponding to the different exposure times of the laser projectors 20 and 22).

14. Claims 46, 30-34, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,495,337 by Goshorn et al. ("Goshorn") in view of U.S. Patent 4,767,212 by Kitahashi, as applied to claims 44 and 40, in view of U.S. Patent 6,064,478 by Paul et al. ("Paul").

Regarding claims 30 and 46, Goshorn discloses illuminating the surface of the object with a visible light (laser 54 from projector 22, figure 1). However, Goshorn is silent to the visible light being at a second wavelength that is different from the first wavelength (for laser 53 from projector 20).

Paul discloses an inspection system (figure 1), which utilizes a plurality of light sources (L1, L2) to inspect an article that is moving with respect to the light sources, similar to that of Goshorn. In particular, Paul discloses that the light sources L1 and L2 are of different colors (i.e. wavelengths). Column 3, lines 51-53.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Goshorn by Paul so that Goshorn's "light" and "visible light" are at different wavelengths, since Paul teaches that utilizing different wavelengths permits surface defects to be easily recognized as changes in color (column 4, lines 4-8).

Regarding claim 31, the combination of Goshorn, Kitahashi, and Paul teaches the image-capturing step includes capturing a second image of the surface illuminated by the visible light at a second wavelength (i.e. Paul discloses an RGB camera to capture three different images corresponding to three different wavelengths), and wherein the method further comprises the step of determining 2-D information for any surface structures by analyzing the second image (column 7, lines 36-45 and figure 2b of Goshorn: a base distance B_{SR} is calculated by the processors 21A-21H based on the images of the surface containing the visible light source; Goshorn discloses using eight cameras, as shown in figure 3, and the images from all of the cameras are used in determining 2-D information).

Regarding claim 32, the combination of Goshorn, Kitahashi, and Paul teaches the image capturing step is performed by a camera operable to capture separate images corresponding to light of the first wavelength and of the second wavelength (i.e. Paul discloses an RGB camera to capture three different images corresponding to three different wavelengths).

Regarding claim 33, the combination of Goshorn, Kitahashi, and Paul teaches the visible light at the second wavelength is emitted by a visible light source that is strobed at a second predetermined exposure time (i.e. Goshorn's laser 54 from projector 22 is strobed at an exposure time different from the first laser 53, so that the two lasers alternately illuminate the surface).

Regarding claim 34, the combination of Goshorn, Kitahashi, and Paul teaches the predetermined exposure time for the coherent light source and the second predetermined exposure time for the visible light source are different (i.e. Goshorn's two lasers are alternately illuminated, thereby having different exposure times).

Regarding claim 38, the combination of Goshorn, Kitahashi, and Paul teaches the 2-D information is combined with the height information to create a profile of structures on the surface of the object (column 20, lines 5-12 of Goshorn: the 2-D information is combined to the elevation information to create a volume profile of structures on the surface of the object).

15. Claims 48-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,495,337 by Goshorn et al. ("Goshorn") in view of U.S. Patent 6,064,478 by Paul et al. ("Paul").

Regarding claim 48, Goshorn discloses illuminating the surface of the object with a visible light (laser 54 from projector 22, figure 1). However, Goshorn is silent to the visible light being at a second wavelength that is different from the first wavelength (for laser 53 from projector 20).

Paul discloses an inspection system (figure 1), which utilizes a plurality of light sources (L1, L2) to inspect an article that is moving with respect to the light sources, similar to that of

Goshorn. In particular, Paul discloses that the light sources L1 and L2 are of different colors (i.e. wavelengths). Column 3, lines 51-53.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Goshorn by Paul so that Goshorn's "light" and "visible light" are at different wavelengths, since Paul teaches that utilizing different wavelengths permits surface defects to be easily recognized as changes in color (column 4, lines 4-8).

Regarding claims 49 and 50, the combination of Goshorn and Paul discloses that the visible light at a second wavelength is emitted by a visible light source that is strobed at a second predetermined exposure time (i.e. Goshorn's laser 54 from projector 22 is strobed at an exposure time different from the first laser 53, so that the two lasers alternately illuminate the surface).

16. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,495,337 by Goshorn et al. ("Goshorn") in view of U.S. Patent 4,767,212 by Kitahashi, as applied to claim 40, in view of U.S. Patent 5,055,667 by Sayag.

Regarding claim 39, although Goshorn is silent to the computer including means for integrating the height information over the length of an exposure to calculate average height, this limitation is a common feature of imaging devices that were known at the time the invention was made.

Sayag provides a general background of the functionality of semiconductor imaging devices, such as CCDs. Sayag teaches that CCDs capture images, inter alia, by accumulating charges during an integration (exposure) period, and the amount of charge accumulated provides a measure of the average radiant energy (column 1, lines 37-40). Therefore, information

pertaining to height (e.g. beams 53 impinging on object 12 in figure 1 of Goshorn) is average values due to the integration performed by the CCD during the exposure intervals.

Allowable Subject Matter

17. Claims 35-37 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 35, the combination of Goshorn, Kitahashi, and Paul does not fairly disclose or suggest illuminating the surface with light at a third wavelength, the third wavelength being different from the first and second wavelength ... and determining two-dimensional information for any structures in the region by analyzing the third image. While Paul discloses utilizing three visible light sources at different wavelengths, there does not appear to be any motivation or suggestion to modify Goshorn by Paul so that a third laser light source is added to Goshorn's system, which includes only two laser light sources. Also, since there is no motivation to include the third light source at a third wavelength, thee is also no teaching of "determining two-dimensional information for any structures in the region by analyzing the third image."

Claims 36 and 37 depend from 35 and would be allowable for the same reasons.

Related Prior Art

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 5,555,090 by Schmutz

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (571) 272-7423. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (571) 272-7414. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (571) 272-2600.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CML
Group Art Unit 2623
7 April 2005

VIKKRAM BALI
PRIMARY EXAMINER